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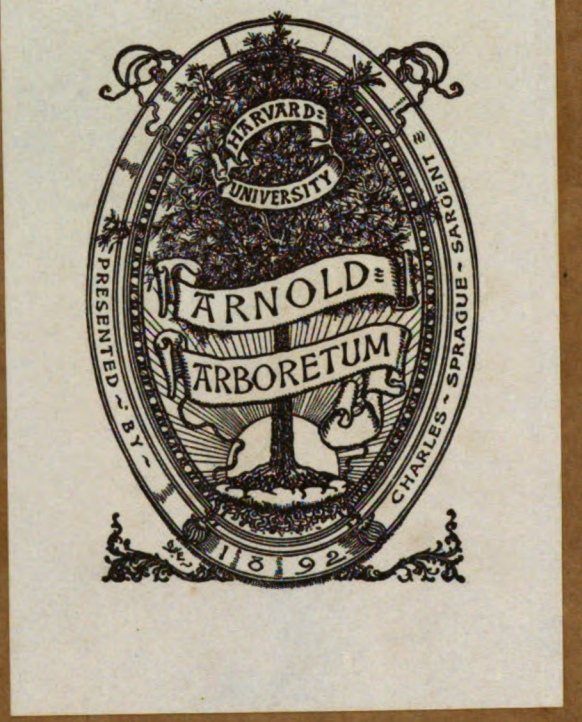

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THE STUDY OF TREES
IN OUR PRIMARY SCHOOLS

By CLARENCE MOORES WEED, D.Sc.

UNDER THE DIRECTION OF

Prof. FRANK WM. RANE, M.S.

Massachusetts State Forester

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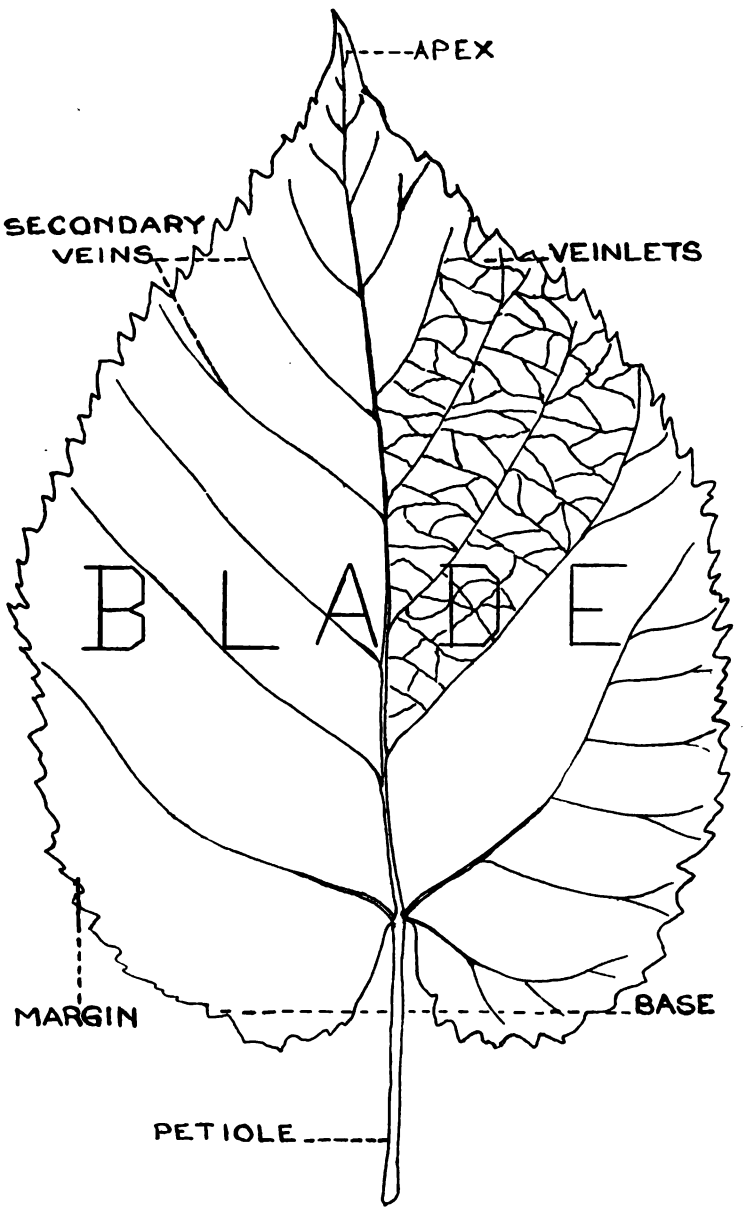

A DIAGRAM OF LEAF STRUCTURE

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INTRODUCTORY NOTE

THIS publication is offered by the State Forester for the use of teachers in elementary schools, kindergartens, the home, etc., believing that our future results in forestry development in Massachusetts and the nation will be largely in proportion to the love for trees, woods and forestry, imbued in coming generations.

Any teacher who will take a class of children into the open and call their attention to the trees, explaining how they live and grow, the different kinds, etc., will find there is little difficulty in exciting lasting interest.

Young folks like to get out into the exhilarating open air in the fall to kick up their heels and enjoy unrestraint. If, in addition to this, it can be demonstrated that there is a real purpose for such excursions or tramps, the occasions will be productive of great good.

There are few subjects in Nature offering a more interesting and well-equipped laboratory for the teacher and class than this method of studying trees. Trees are ever with us, summer and winter, autumn and spring, and to the thoughtful observer offer constantly changing and untiring interest.

In the fall when school is opening, there are the nuts, fruits and autumnal foliage to gather; in the winter the twigs, buds and forms of the trees to study; and, with the

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bursting verdure of spring and early summer, come the flowers, growth, seedlings, shade, etc., — a yearly round of charming association.

ACKNOWLEDGMENTS

Dr. Clarence Moores Weed of the Lowell State Normal School was selected to prepare this manuscript. Professor Weed needs no introduction to the public school fraternity in New England, being a well-recognized educator and author in natural history lines.

Mr. George H. Martin, Secretary of the Massachusetts State Board of Education, kindly read the manuscript and has given it his hearty approval.

The drawings for the illustrations were made by Miss Alice Manning of the class of 1906 of the Lowell Normal School.

It is the purpose of the office of State Forester to encourage modern forestry in every way possible throughout this State. Superintendents and teachers in our schools will always receive our heartiest co-operation. It is hoped that this pamphlet on "The Study of Trees in our Primary Schools" will serve as a good beginning for greater ultimate results in practical forestry.

F. W. RANE,
State Forester

State House, Boston, Mass.,
Oct. 1, 1907

Approved by the State Board of Publication

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The Study of Trees in our Primary Schools

AMONG all the living things in the outer world that may be utilized in the Nature study of the schools, the trees may fairly claim a leading place. They are found practically everywhere that schools flourish; they are always present in a condition worthy of study at any season of the year; they change from week to week and from month to month, so that they present in spring, summer, autumn and winter, varying phases of great interest and beauty. Perhaps more important than all else, they furnish, for the taking, a great wealth of material which may be brought into the schoolroom for actual first-hand contact by the pupil with the infinite variety of Nature. In autumn, the wonderful hues of the falling leaves, as well as the glorious forms and colors of the maturing fruits, furnish an almost embarrassing richness of material for the teacher. In winter, the leaves, cones and branches of the evergreens, as well as the buds and twigs of the deciduous trees, furnish almost equally interesting opportunities for study. In spring and summer, the buds unfolding into leaves, and the blossoms maturing into fruits, furnish again a wealth of material so vast that one must select with much discretion that which is to be used.

It is often recommended that the Nature work with trees, in the lower grades, be confined to a single tree or a single kind of tree, which is to be exhaustively studied throughout the year. This advice is based upon the principle that a complete whole is to be studied rather than any part, but it does not take into account two facts: first, that the leaf of a tree is an organic unity, and second, that little

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children are more interested in and better able to appreciate the small unit of the leaf than the large unit of the tree. It also fails to take into consideration that a little child touches Nature in a cursory way at a thousand points rather than makes an exhaustive investigation at any one point. Consequently, the wise teacher in the primary school will utilize the natural interest of the children in the brightly-colored leaves of autumn, to give them vivid images of a considerable number of kinds of trees rather than to attempt to give them a complete knowledge of any one tree.

Every resourceful teacher will have her own methods of making her pupils acquainted with the more distinctive trees in their environment. Fortunately, practically all of our trees may be most easily known by their leaves, which are to be had in such abundance and in such beauty through the autumn months, and which the children naturally love to gather on their way to school, even from the very gutters of the city streets.

Every teacher will, of course, realize that any successful method of getting the children acquainted with the leaves of trees will depend upon actual contact with the real thing through the senses of the pupil. Seeing, feeling, smelling, tasting, hearing — all these may be utilized in leading the children to get definite and vital images of the trees and their leaves; and the more definite and vital these images are, the more complete will be the acquaintance of the pupil with this important feature of the great outer world. And the thoughtful teacher will also realize that these images are best obtained through such activities of the pupil as will enlist his interest throughout his whole being — that the sense games are most successful when the images appear to be a matter of secondary importance, of the significance of which the pupil may be entirely unconscious. Some of the methods by which the natural activities of the pupils may be utilized in the study of trees are indicated in the following paragraphs.

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EXERCISES FOR VISUAL IMAGES

ASSORTING LEAVES

IT is well known that in the case of very young children color appeals before form. Consequently, the teacher in the lowest grade who desires to have her pupils work with the autumn leaves may well use a little care in selecting material of distinctive colors. From certain trees, like the Red Maple, it is a simple matter to get leaves in quantity whose prevailing tones are distinctly red. From others, like the Sugar Maple, the Large-toothed Poplar, or several other species, it is equally simple to get leaves whose prevailing tones are distinctly yellow. From still others it is easy to get brown leaves, while, of course, it is the simplest matter to provide the green leaves. If each child is furnished with a little portfolio having several leaves of each of several distinct colors, their assortment, as to coloring, into piles will be a pleasurable activity. After some experience of this kind, the assortment of a set of green leaves of the same species as the colored ones, in which the form of the leaf serves as a basis of assortment, will be comparatively easy and will serve to give the pupils definite images of the more distinctive leaves.

At first, little children will do this assorting by picking out one kind of a leaf at a time, as it is easier for them thus to keep in mind but one image at a time.

This assorting is, of course, an exercise in discrimination and has decided value for development of mental power, in addition to giving the children definite visual images of the leaves utilized.

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MOUNTING LEAVES

Charming little leaf-books may be made by letting the children press and mount the fallen autumn leaves. For pressing, a few old books will answer very well, or the botanical dryers cut to one-half or one-fourth their usual size may readily be utilized. These botanical dryers may be purchased from any of the school supply houses, and are usually twelve by eighteen inches. By cutting them in two in the middle they become nine by twelve inches, and by cutting again they become six by nine inches, a very convenient size for little children's use. The fallen leaves will dry very quickly and are less brittle than green leaves which are pressed and dried. Consequently, they are easier for the children to handle. They may readily be mounted by the use of gummed paper. Single mounts upon rather stiff paper will serve very well for the children to carry home from day to day, always being sure that the child knows the name of the particular leaf mounted; while later another set may be mounted to form a book of leaves, which may be utilized for Christmas presents or other purposes. Opportunities in this direction are only limited by the skill, interest and ingenuity of the teacher.

COLORING

The leaves offer abundant opportunity for color work by the children. One method of doing this is for the teacher to supply each pupil with a paper on which an outline of a leaf has been traced, the child having also a leaf of an appropriate color for filling the area of the blade. In tracing these outlines, pasteboard models may sometimes be used to advantage either by the teacher or the more advanced pupils. Booklets made of these are more likely to be per-

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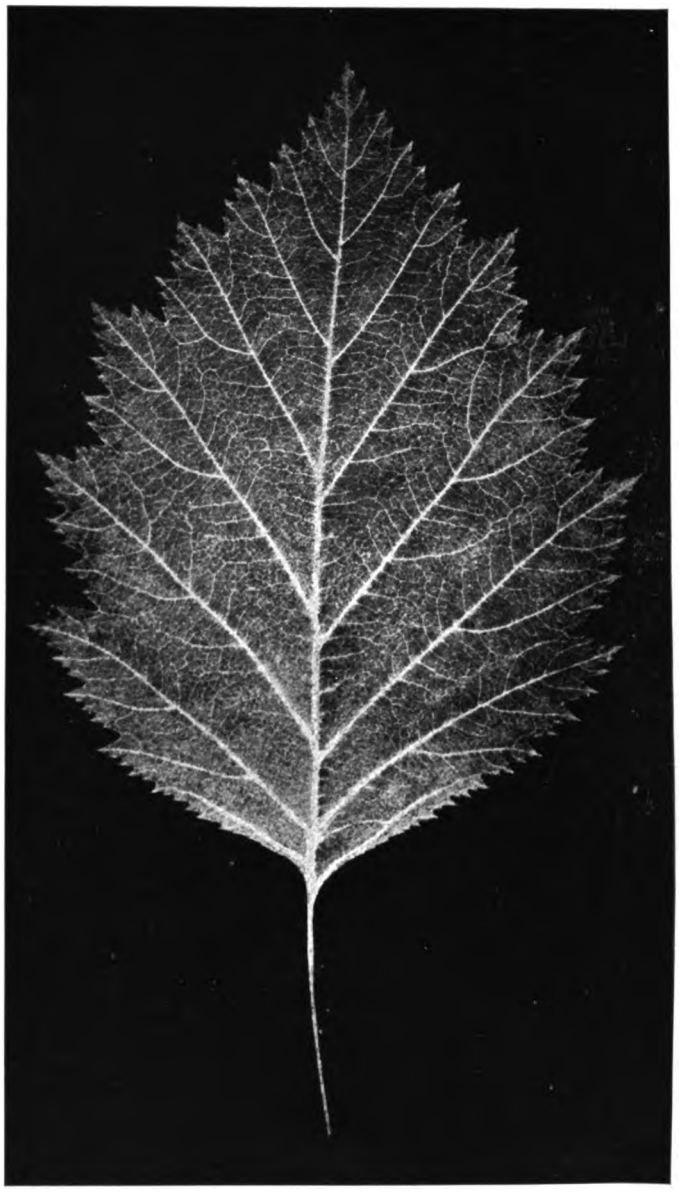

VAN DYKE SOLAR PRINT OF HAWTHORN LEAF

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manent than those made of the leaves themselves, because the latter are liable to become loosened. Or the pupils may trace around the leaves and then fill in with color.

LEAF AND KEY-FRUIT DESIGNS

The leaves of many trees and the key-fruits of Maples, Ash trees, the Hop tree and others may readily be utilized in making designs of various kinds upon the desks or the table, where, upon good-sized sheets of paper, the pupils may arrange them in squares, circles and other forms, as a part of the so-called busy-work of the desk periods.

LEAF PRINTS

The fascination found in taking and making pictures is universally acknowledged. If given time and materials, a large proportion of educated people would enjoy the delight of photography, but many are deprived of such enjoyment by the lack of time and many more by the lack of equipment, of which a good camera is the most essential part. One can, however, make beautiful pictures of a large proportion of the innumerable forms of plant life without a camera and with an equipment so simple and inexpensive that anyone can afford it.

Essentially the method thus suggested is that of making prints directly from a leaf or flower or other form of plant life upon photographic paper. This method has been occasionally utilized in making blue-prints, but it is now possible to get much more beautiful results from the use of various other papers.

One needs for this work only one or more ordinary photographic printing frames, with a piece of plain glass to fit it and some sensitized photographic paper. By laying a leaf on the glass and a sheet of paper over it, and then exposing to light the time required by the

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paper, and toning or developing as the particular paper used may necessitate, one is able to make a print in the same way that it would be made from an ordinary photographic negative. This print, however, will be a negative print, that is, the margin around the leaf will be dark and the leaf will be light. But admirable positive prints, in the case of some papers, may readily be made by using this print as a negative, placing it on the glass as the leaf was placed before, and making another print from it. This will be one in which the background will be light and the leaf be dark.

In general one can get two distinct sorts of leaf-prints, namely, silhouette prints and venation prints. The former are prints obtained by short exposures or from thick leaves; the latter by longer exposures or from thin leaves. The venation prints are, of course, the more beautiful and on the whole much more satisfactory, and as a rule the negative venation prints are better than the positive.

Of course it is desirable to have the specimens used in printing absolutely perfect, as any imperfections will be reproduced in the picture. The best time to get sprays of leaves—and sprays make more attractive pictures than single leaves—is in spring when the foliage is freshly expanded. By taking the specimens desired and pressing them between blotters or in books one can dry them in a few days so that they may be used to great advantage. These spring specimens, however, do not yield such distinct venation prints as do the autumn leaves, when most of the green coloring matter that obstructs the light rays has disappeared. From such autumn leaves one can quickly get beautiful negative prints which show every detail of venation.

I have used a great variety of photographic papers in making these prints. The Argo, Velox, or other artificial light developing papers may be used if the printing is to be done after dark, but if it can be done by day the sun-printing papers are better. Of these the cheapest and most satisfactory is the Van Dyke solar paper which gives prints

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SILHOUETTE LEAF-PRINT OF SILVER MAPLE

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in beautiful tones of brown. This paper is cheap and may be used in the light of a schoolroom on sunshiny days.

These leaf-prints are of fascinating interest to children and help greatly in giving vivid visual images of the leaves. The prints are admirably adapted for mounting in the leaf booklets, and are especially effective to use on brown covers of such booklets in any of the grades.

CLAY MODELLING

Many of the autumn leaves may be utilized to advantage in making prints upon flattened cakes of modelling clay, the leaf being pushed into the clay in such a way as to make a distinct impression. Of course here, as always, the child is to know the name of the particular kind of leaf with which he is working.

DRAWING LEAVES

Pupils in the third grade and those above are able to do a great deal in the way of drawing leaves, and such exercises are of great value in fixing definite images in their minds, as well as in giving them the ability to express graphically what they see. The surest way to determine whether the forms of the various leaves are definite in the mind of the pupil is by means of memory drawings; and teachers are likely to be surprised to find how easily and well young children will draw from memory the forms of the leaves that they have studied.

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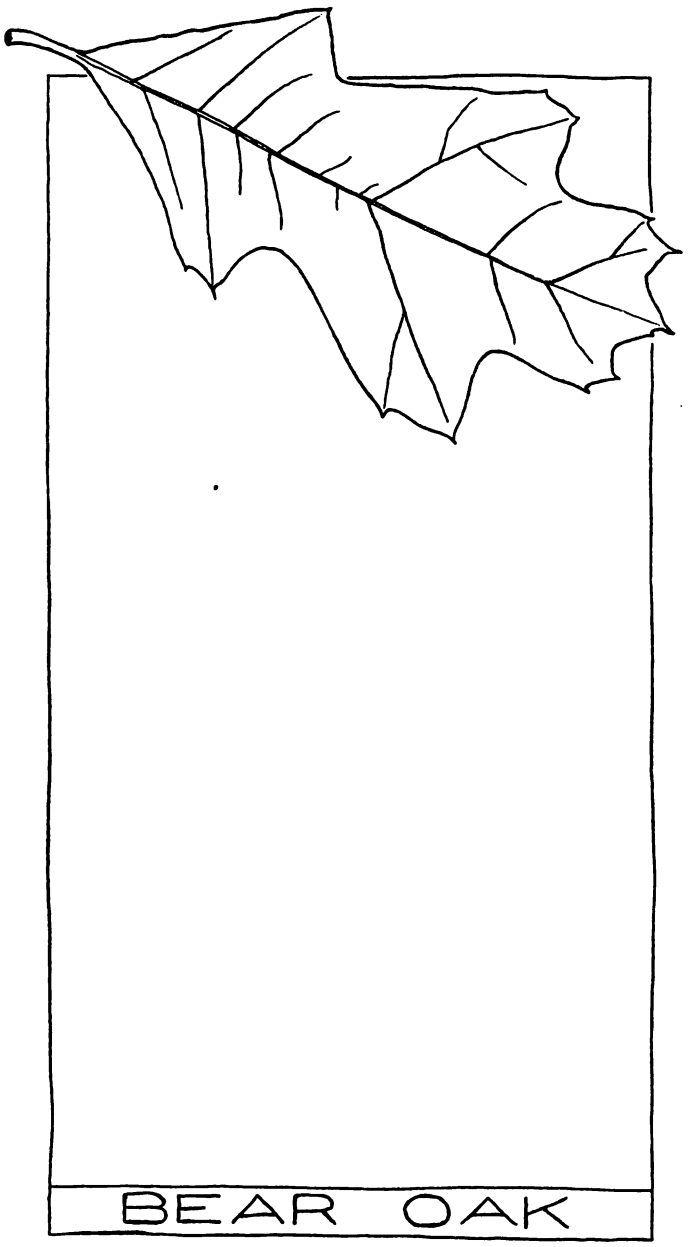

SUGGESTION FOR BLACKBOARD DIAGRAM

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EXERCISES FOR SENSE PERCEPTIONS

TOUCH

THE leaves in autumn furnish splendid opportunities for exercising the sense of touch. Among the species listed on the following pages there are great variations in the leaf surfaces of the different sorts, as well as often of the two sides of the same leaf. The White Poplar is a striking illustration of the latter, the woolly under-surface having a very different feeling from the shiny upper surface. Many ways of utilizing the leaves in games of touch will be found by the wise teacher who takes up the study of the leaves.

SMELL

Several of the leaves on the following lists have distinctive odors which may be utilized in exercising the olfactory sense. This is notably true of the Sassafras and the Balm of Gilead, although to a less extent of others. Of course, when the visual image of a leaf of a given tree can be reinforced by a distinctive olfactory image, the wise teacher will avail herself of the opportunity.

TASTE

The petioles of a few of the leaves have a distinctive taste by which they may be readily recognized. The Sassafras is a notable illustration of this. As always, however, in cultivating the sense of taste with natural objects, great care must be taken not to get the pupils into the habit of tasting trees and other plants indiscriminately.

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thing the more firmly will it lodge in the memory. The physiological psychologist states the truth thus: 'Repeated actions of the same kind tend to make the corresponding brain modifications permanent.'"

In no phase of school work is this cerebral development by means of the formation of images of more importance than in the kindergarten and primary schools. The brain of the child is then in its most plastic condition, eager for new experiences and equally eager to live them over in vivid imagery. The school methods in the lower grades are also particularly adapted to such recall of images. These may be readily utilized in a great variety of ways. In the stories and games there are ideal opportunities for letting the children form vivid images of the animals and plants with which they have become more or less familiar, and thus to add to their real knowledge of their environment, as well as to help greatly in the development of the physical basis of their mental life.

EXCURSIONS

Excursions for the study of leaves in autumn are particularly easy to take and are especially likely to yield interesting results. After the leaf of a given kind of tree has been studied in the school, the children will appreciate all the more a visit to such a tree where they may gather more material for their in-door occupations. Certainly no one can object to their picking up as many of the beautiful colored leaves as they desire and carrying them to school. The way in which the leaves fall from the tree and the way in which the wind plays with them may often be seen on such excursions. A bright morning in September or October, following a frosty night, is particularly desirable for such an outing, because the pupils can then readily watch the leaves as they gently fall to the ground.

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A FIRST GRADE LESSON

AS an illustration of the methods which may be successfully employed with first grade pupils in the study of leaves, I reprint below the description of a lesson given by Miss Alice Barrett of the Bartlett School in Lowell, the lesson having been described to the New Hampshire State Teachers' Association and printed in the report for 1904:

"It is a very simple lesson," says Miss Barrett. "I am afraid to you it will lack the charm the children gave it. It was given last Friday, the first day of sunshine after a week of clouds. Everything was so beautiful that morning! The children spoke of their own accord of how beautiful the leaves looked with the sun shining on them. 'Why, they looked just like gold!' one little girl cried. The rain had sent many fresh ones down and the children had come in laden with beautiful leaves for us to work with that morning.

"We sang the old song you are doubtless all familiar with:

'Come little leaves,' said the wind one day,
'Come o'er the meadows with me and play;
Put on your dresses of red and gold,
For summer is gone and the days grow cold.'

"We also sang the beautiful little song in 'Song Echoes', entitled 'Autumn Leaves Falling.'

"Then followed some questions: 'What did the wind tell the leaves to do? What did it tell them to put on? Have you seen any that have put on colored dresses? Can you find any that have put on yellow dresses? Name. What other colors do some put on?' "Red." 'Who can find the red leaves and name them? What color have these leaves been all summer? Can you find some that are still green?'

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"'What did the leaves do after they put on autumn dresses?' "Came softly down to us." 'How did they come? Show me. How beautiful were they as they came down? Did you try to catch any? Were you glad to have them come? What else was glad?' "The garden," said one little girl. 'What in the garden?' "Seeds and grasses." 'Why?' "So the snow won't hurt them. The leaves cover them up with a brown blanket." She evidently remembered a kindergarten song of last year.

"I then gave each child several leaves to look over and assort. They enjoyed it very much and were anxious to see who would get them assorted first. Some leaves perplexed them, for I had purposely put in leaves they had never seen before to see what they would do. They soon discovered that they were strangers to the other leaves, so put them one side. It was interesting to watch them at work, — one little fellow, particularly, for he reasoned aloud softly to himself as he worked, 'Why, that is a sugar maple and this is another. Why, look! Miss Barrett, I have two sugar maples.' "How do you know, Herbert?" 'Why, they have five points, don't you see? I don't know what this leaf is. Oh, yes, I do, it is a red maple. It has three points. This is a tulip tree leaf because it is cut off at the top. This is a willow. It is long and slim.'

"When their work was done, I asked each child to select one of his leaves and tell me its name, and how he knew it was such a leaf.

"Then we played a game. I described a leaf or a tree and they found the leaf quickly and told me its name. For instance, — 'I am thinking of a long leaf that has many round points, that grows on a tree with nuts that the squirrels like to eat.' "Oak," they instantly cried and held up that leaf. 'Now I am thinking of a tree that grows by the brook. Its leaves peep over the brook into the water. In spring it has soft, furry blossoms which you like to pick. Who can find its leaf?'

"'Now I am thinking of a smaller, one-pointed leaf. It is rough and on its edge are little teeth like those of a saw. It grows on a tall tree where the oriole builds its nest.'

"'Now I am thinking of a leaf something like the maple but larger. It has three large points but the little points are hooked.' With this we noticed the base of the stem covering and protecting the bud.

"In this way we proceeded with the leaves.

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"Then the children closed their eyes while I placed in each hand one of the familiar leaves. By feeling and tracing they told me its name. If they were not able to do this, they opened their eyes, looked at it carefully and found others like it.

"I then brought forward some apple leaves and asked, 'How many would like to learn about a new leaf this morning? It is another leaf I found in the orchard. You may each have one and see if you know its name.' A few did know it and told us what fruit grew on this tree, that boys and girls liked very much. I asked what other leaf grew in the orchard. They told me the pear, a leaf they had previously studied. We compared the two fruit leaves. They observed the outlines. The apple was rounder. They traced around the edges. "The apple has teeth like a saw," one boy observed, remembering what we had said about the elm leaf. We felt of our leaves: the pear was very smooth and shiny; the apple, hairy, furry.

"Then I sent them hunting for more leaves like the one they had. Paper and pencil were then given them to trace around the leaf. They noted that the leaf was still green, so chose green crayon with which to color. Each child took his apple leaf home to show mother and to find more leaves like it. Several were successful and so before night we had several names to add to the diagram for the apple leaf.

"Apples were also painted; first, the color they were when the leaves covered them so successfully, then in their bright coloring when the leaves would hide them no longer.

"Then, when our leaves and fruit were done, we sang a song about the place where they grew:

> Down in the dear old orchard, where ruddy apples grow,
> Often the children gather to swing and frolic here.
> No place is like the orchard, so pleasant and so dear!

"Thus we tried in a simple way to associate each leaf with the child's natural activities, and thus help him to take a more vital interest in one of God's most wonderful and beautiful gifts to him."

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LISTS OF TREES FOR LOWER GRADES

In the selection of species for these lists, the following ideas have been borne in mind:

1 To select for the youngest pupils the most diverse forms, so that the visual images will be distinct and easily differentiated.

2 To include in some cases related forms which have points of difference easily grasped by young pupils, as in the case of the White Oak and the Red Oak, of the Aspen and the Large-toothed Poplar.

3 To include as many trees as practicable which may be utilized in sense impressions through feeling or smelling, thus re-enforcing the visual images.

4 To include the common and widely-distributed Massachusetts trees, with the idea that in certain cases cultivated trees may be utilized when available. The Ginkgo, for example, is so extraordinary a leaf type that it always appeals to little children, and may be utilized where specimens are accessible.

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THE STUDY OF TREES IN OUR PRIMARY SCHOOLS

FIRST YEAR

1 Tulip Tree
2 Sugar Maple
3 Red Maple
4 White Poplar
5 White Oak
6 Red Oak
7 Bear Oak
8 Balm of Gilead
9 Willow
10 Apple
11 Pear
12 Gray Birch
13 Aspen
14 Large-Toothed Poplar
15 Horse Chestnut

SECOND YEAR

16 Catalpa
17 Silver Maple
18 Sassafras
19 Buttonwood or Sycamore
20 Beech
21 Elm
22 Red Birch
23 Alder
24 Common Locust
25 Butternut

THIRD YEAR

26 Chestnut
27 Canoe Birch
28 Hawthorn or Thorn Apple
29 Norway Maple
30 Cottonwood
31 Ash-Leaved Maple
32 Ash
33 Sumach
34 Hickory
35 Honey Locust

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TREE-PLANTING AND TREE GARDENS

THE study of trees may well culminate in the encouragement of each pupil to plant trees for himself. These need not be large trees, requiring effort and energy for transplanting; they may well be small seedlings, such as are to be found almost anywhere during spring. They may be transplanted very easily and are more likely to grow and thrive than if they were larger. The apperceptive basis for finding these seedlings may easily be given the pupils by bringing into the schoolroom a few such seedlings and having them make drawings of them for their tree booklets. The maples and oaks are particularly serviceable in this connection.

These seedling trees serve admirably for teaching the tree as a whole and will prove attractive in this connection even to little children. The root, the stem, the seed leaves and the foliage leaves are all present in miniature, and in a size to be comprehended by the smallest child.

The simplest and most satisfactory way to encourage the planting of trees, as well as to give the pupils a real and lasting interest in the subject, is by means of a tree garden in which the pupils plant the seeds or seedlings of trees and watch them grow. A tree garden is a very simple thing to establish, and it can be carried on successfully in connection with almost any school where a few feet of ground can be spared for the purpose. It will be a source of constant interest and furnish a rich supply of material for Nature, language and drawing lessons, as well as a supply of young trees for planting in home grounds and in public highways. The beginning of such a garden would be a most fitting way of celebrating Arbor Day.

NOTE. — Any teacher wishing to start a tree garden should send to the Secretary of Agriculture, Washington, D. C., for Bulletin No. 29 of the Forest Service, entitled "The Forest Nursery;" and to the Massachusetts State Forester, for bulletins on tree-planting. Massachusetts teachers should utilize the specimens freely offered by the State Forester for tree garden purposes.

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FIRST YEAR

Tulip Tree. The leaves of the Tulip Tree have an extraordinary attraction for little children, the odd form appealing to them with especial force. These leaves are beautiful whether in the green of their summer dress or the brilliant yellow of their autumnal tones. In outline they are different from any other leaf, and their smooth and shiny surfaces may be utilized in training the sense of touch. The fallen leaves are especially desirable for mounting, as they are of a good yellow color and so firm in texture that they do not break easily.

Although the Tulip Tree is not a native throughout most of the more northern states, it has been generally introduced for shade and ornament, and one or two trees from which the fallen leaves may be obtained are likely to be found in almost any town or city. It should be one of the first trees planted on or near the school grounds.

Sugar Maple. The Sugar Maple is one of the trees which is likely to be utilized in every school where any attempt at an acquaintance with the outer world is made. The trees are so generally distributed in the wild state and have been so universally planted for shade that they are likely to be found almost everywhere. The beautiful colors in yellow, orange and red which the leaves take on in autumn are sure to attract the notice of the little children, who will gather them from the sidewalk on their way to school. They should, of course, be encouraged to make such collections, and the material

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thus brought in may readily be pressed and mounted as a part of the regular work. The key-fruits of this tree generally fall about the same time that the leaves drop off, and the children should be led to notice these also. These key-fruits have not the beauty of form or the large size of the key-fruits of the Norway Maple, and are not so desirable for mounting as are the latter. The Sugar Maple leaves, however, may be utilized to great advantage in connection with the study of color, and the children should be led to notice the rounded divisions between the lobes, which differentiate the Sugar Maple from the Red Maple.

Red Maple. The leaves of this tree are especially desirable for use on account of the beautiful tones of red that they take on as they fall in autumn. This species is very generally distributed throughout the United States and has been largely planted in cities and towns as a shade tree. Most children will readily learn to distinguish these leaves from those of the Sugar Maple, both by the more brilliant color and by the acute angle of the sinus between the upper lobes of the leaf.

White Poplar. The White Poplar is a very generally-introduced tree, with a leaf that is distinctive on account of the striking difference in color of the upper and under surfaces and especially the dense, woolly covering of the latter. The leaves are thick and easily pressed, and where found at all may be gotten in sufficient abundance so that each pupil can mount at least two specimens, that each side may be shown. The leaves serve admirably for tactile determination, and there should be no difficulty in the children telling by the sense of touch the two sides of the leaf. The dark brown color taken on by the leaves after they have fallen to the ground is one which the children should learn to recognize.

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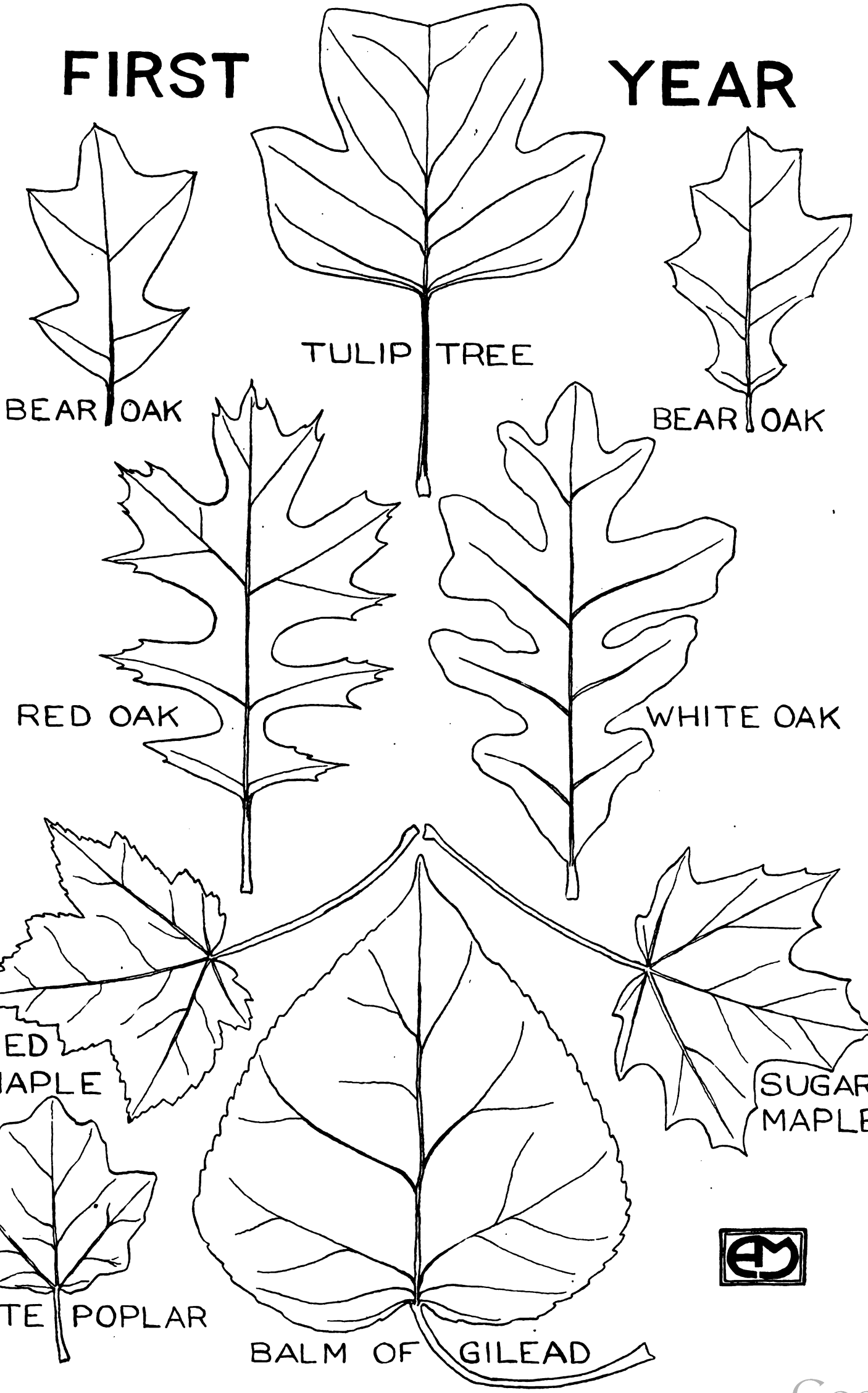
FIRST YEAR



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Like the other Poplars, this species grows rapidly, and a small tree will furnish all the material needed for school purposes. The leaves are variable in shape, and rows of the smaller ones might readily be utilized in making border designs upon cardboard. The younger leaves are more densely woolly than the older ones, the under-surface being sometimes smooth in the latter.

White Oak. The Oaks in general are divided into two distinct groups, the White Oaks and the Red Oaks. In the former the lobes of the leaf are rounded, while in the latter they are more or less acute and generally bristle-pointed. The familiar White Oak is an abundant and widely-distributed tree, the leaves of which are easily recognized by little children. Many of these leaves change to a beautiful red color in autumn, turning brown later in the season and commonly hanging upon the twigs late into winter. Their firm texture makes them excellent objects for use in school work, as they can be readily handled and mounted by the pupils themselves. The acorns of the White Oak are small and beautiful in form and color, and should be utilized in connection with the study of the leaves.

Red Oak. The acute, bristle-pointed lobes of the leaves at once distinguish the Red Oak from any members of the White Oak group. Classed with the Red Oak are the Black Oak, the Scarlet Oak and various other species, in all of which the lobes of the leaf are similar. For the present purpose it is not worth while to attempt to discriminate between these species, although for the teacher's satisfaction it is desirable that the precise species should be known by her. If the leaves on a given tree have the general outline of the accompanying picture and the inner bark on the larger branches or the trunk is of an orange-yellow color, the tree is a true Black Oak. If the inner

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bark is of a pinkish-gray color, with large acorns in shallow cups, the tree is a Red Oak. The leaves of these Oaks are smooth and shiny and take on beautiful hues of red in autumn. They are attractive to children, who enjoy working with them as well as with the acorns which should be studied in connection with the leaves.

Bear Oak. The shrub or dwarf tree, called the Bear Oak, is very generally distributed in Massachusetts, and its oddly-shaped leaves seem to appeal with special force to little children. The small acorns are generally produced in great abundance and it is said that in early colonial times the bears were often seen feeding upon them. It will be a very simple matter in almost any locality to get one of these shrubs planted along the borders of the school grounds.

Balm of Gilead. The leaves of the Balm of Gilead are especially desirable for use in the early years of school on account of their beautiful form, their characteristic odor, their waxy surface and their excellent autumnal coloring. As regards form, they are typical heart-shaped leaves, the most distinctly so of any of the trees mentioned in these pages except the Catalpa. They are firm and will bear considerable handling after being pressed for a very short time, and the fallen leaves with their bright yellow colors may be mounted on green or violet-blue paper to distinct advantage. The upper surface of the leaf is more distinctly waxy than the under-surface, and probably many children will be able to tell the difference from the sense of touch. The opportunity for the use of this leaf in scent games should not, of course, be neglected.

The Balm of Gilead is a very generally-planted shade tree, and a single tree anywhere within reach of teacher or pupils will furnish an abundance of material through September and October. A twig

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inserted in a bottle of water in autumn will send out roots through the winter and towards spring is likely to develop a small crop of leaves.

Willow. The long, slender leaf of the Willow, with its beautiful serrate outline and its delicate, tapering point, is one of the most characteristic of leaf forms. In general, there is not very much difference in the outlines of the different species of Willows which are commonly found, and almost any of them will serve every purpose in the studies of leaves. The White Willow is probably the species that is most likely to occur within reach of the school. The smooth, shiny upper surface is somewhat lighter green than the under-surface, although the difference between the two surfaces is not nearly so marked as it is in the case of the Pussy Willow or Glaucous Willow. These Willow leaves are very easily pressed and may be mounted by the children to great advantage.

Like the Poplars, Willow twigs will send out roots if placed in a bottle of water, a process which is sure to prove of interest to the children.

Apple. The leaves of the Apple may well be taken up in connection with the fruit of the tree. They are, of course, everywhere available in quantity. Many of them turn to a beautiful yellow color in autumn, and they are so small that they may readily be mounted by the children. The woolly under-surface affords an opportunity for exercising the sense of touch, and the differentiation of the Apple leaf from that of the Pear leaf by touch alone should be an easy matter.

Pear. Like the Apple, the leaves of the Pear are everywhere available and are easy to study in connection with the fruit. As they

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fall in autumn they change to beautiful tints of yellow and orange-red, and may be utilized for color studies and for mounting to great advantage. Their smooth, waxy surfaces are very different from those of the Apple leaf, and, as suggested in connection with the latter, there should be no difficulty in having the pupils distinguish between these two leaves by touch.

Gray Birch. The arrow-like leaves of the Gray Birch, distinctive in their form, are available in quantity throughout Massachusetts. They are of a beautiful, shining green color in summer and when they fall in autumn change to lovely tints of yellow. They are especially desirable for mounting when the fallen leaves have been pressed for a short time, and they may be gathered in unstinted abundance. They are readily known by the long, tapering point, which is different from that of any of the other Birches.

In case the Gray Birch is not to be found near at hand, the finely-divided leaf of the English Cut-leaved Birch, which is so generally planted as an ornamental species, may be utilized.

Aspen. The Aspen is almost as universally distributed in Massachusetts as the Gray Birch. The seedling trees may be found along almost any roadside, and one or more may readily be transplanted near the schoolhouse if there are none already there. The rather small leaves with their fine teeth and smooth surfaces are easily recognized, and when taught in connection with the Large-toothed Poplar, the difference between the two will readily be remembered by the pupils. The flat petiole, characteristic of nearly all the Poplars, will of course be noticed.

Large-toothed Poplar. This species is often called the Large-toothed Aspen. The leaf is characteristic, being usually larger than

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that of the Aspen, and having much larger and more distinct teeth along the margin. The leaves change to beautiful yellow and orange-red hues as they fall. In many localities the trees are nearly as common as those of the Aspen, and it should be a simple matter to plant one or two near the Aspen on or near the school grounds.

Horse Chestnut. On account of its size and unusual structure, as well as of its relation to the large, nut-like fruit, the Horse Chestnut leaf is always interesting to children. It is especially desirable, also, because it serves to give the pupils a good mental image of one of the most distinctive types of leaf structure, that of the palmately compound leaf. This is the only illustration of this type of structure among trees selected for treatment here. The leaves are usually too large and break off too readily at the joints for use by the pupils in mounting; and it does not seem to me desirable that they should be permitted to mount the individual leaflets, for by so doing they get fixed in mind the erroneous impression that these leaflets are leaves of the Horse Chestnut, whereas it is much better that they should get mental images of the whole leaf to connote with their understanding of the Horse Chestnut foliage. One or two leaves mounted upon white cardboard in the hand of the teacher will answer all essential purposes involved in the study of this leaf. It is very desirable that it be supplemented by enough Horse Chestnut fruits so that each child may feel and handle them, and enough of the curious husks from which these fruits come so that each child may understand that the nuts grew within the husks.

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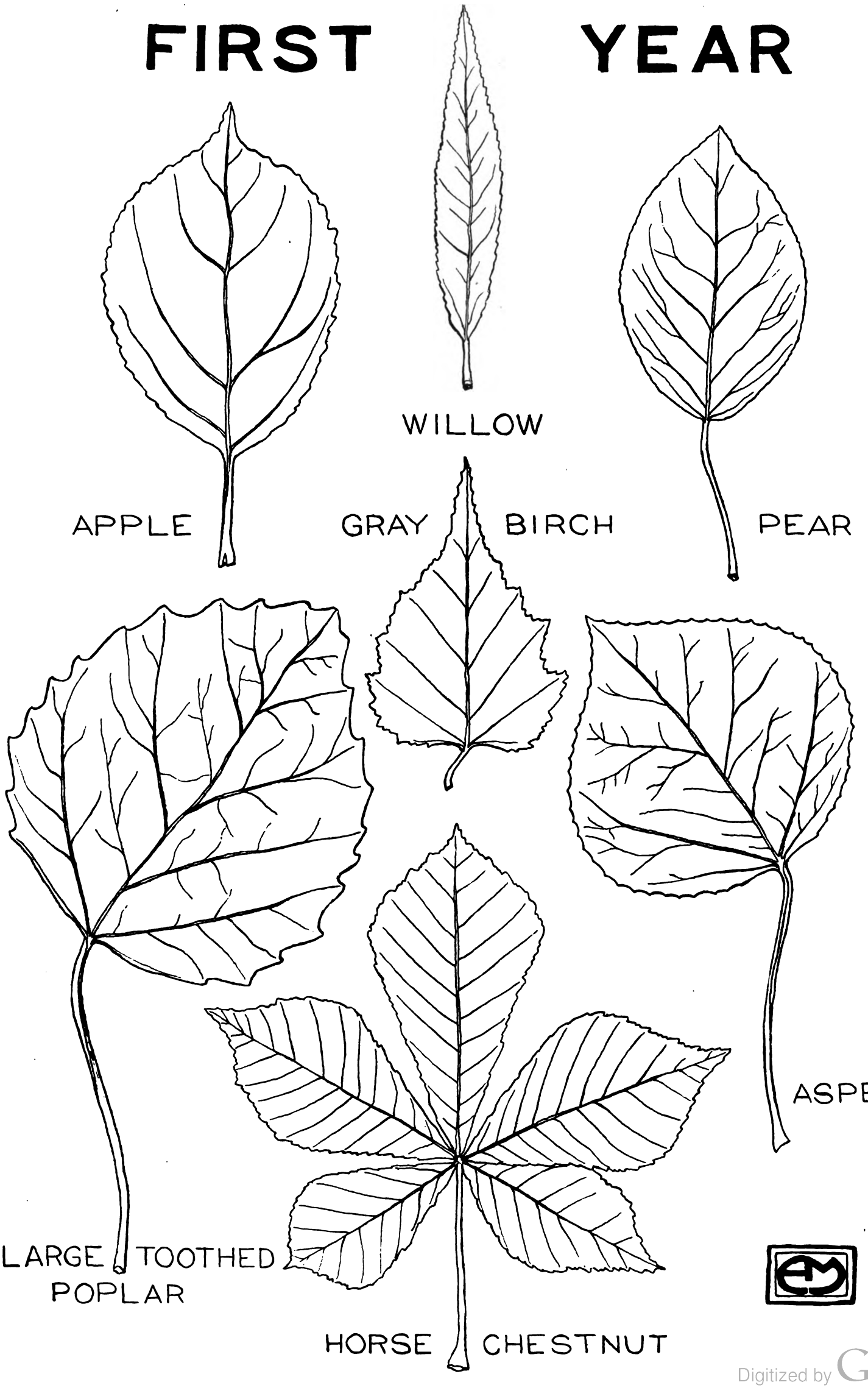
FIRST YEAR



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MOUNTED DRAWING OF SEEDLING TREE

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SECOND YEAR

Catalpa. The large, heart-shaped leaves of the Catalpa bear a general resemblance to those of the Balm of Gilead, and probably the two sorts better not be taught at the same time. If the Balm of Gilead is taught first and the children later take up the Catalpa leaf, they may readily differentiate the two by the absence of the characteristic odor in the case of the latter; or, if the Balm of Gilead is not present within reach of the school, the Catalpa will serve very well as a type of the heart-shaped leaf. The Catalpa leaves, if rubbed together so as to bruise their surfaces, are likely to give out a rather disagreeable odor, which is quite distinct from that of the Balm of Gilead. They are not so attractive in coloring in autumn, turning a very dark brown as they fall. If the long, curious fruit-pods are available, the children should see and handle them in connection with their study of the leaves.

The botanists recognize two species of native Catalpa, which are so similar, however, that there is no necessity for differentiating them in the lower school work. The trees are generally distributed in the Central and Southern States, and have been largely planted for shade and ornament throughout Massachusetts.

Silver Maple. This species is widely distributed both as a native tree and as one planted for shade. It is easily distinguished from the other Maples by the deep, acutely-pointed sinus between the lobes, as

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well as by the white under-surface of the leaf. It may well be taught in connection with a review lesson on the Sugar Maple and the Red Maple, that the pupils may get the essential distinctions.

Sassafras. The Sassafras is another one of the trees which the lower schools should not neglect, because it serves to give the children definite and pleasing taste and odor images, as well as special and significant visual images. The oddly-shaped leaves, many of which are curiously like a mitten, differ from those of any other tree. In addition to the mitten form simple oblong forms are common, and also forms in which there is a lobe on each side. The odor is pleasing and distinctive, and may be brought out to especial advantage by bruising the leaf or a bit of the bark of a twig, and the taste may easily be obtained from the latter. As the leaves fall they are of an interesting yellow color, and serve very well for pressing and mounting.

Buttonwood or Sycamore. The large, curiously-formed leaves of this tree are of especial interest to children on account of the way in which the base of the petiole fits over the bud, a characteristic by which they easily remember it. It is easy to get very large leaves that may be seen clear across the room for use as wall specimens, although most of the leaves are rather large for pressing by the children. The ball-like fruits are also of great interest and serve to fix in mind the name Buttonwood. In many cities the Sycamore Maple is planted as a shade tree, and should not be confused with this species, which is also called the Plane tree. If a tree can be reached on an excursion, let the pupils see the characteristic bark and handle some of the loose flakes.

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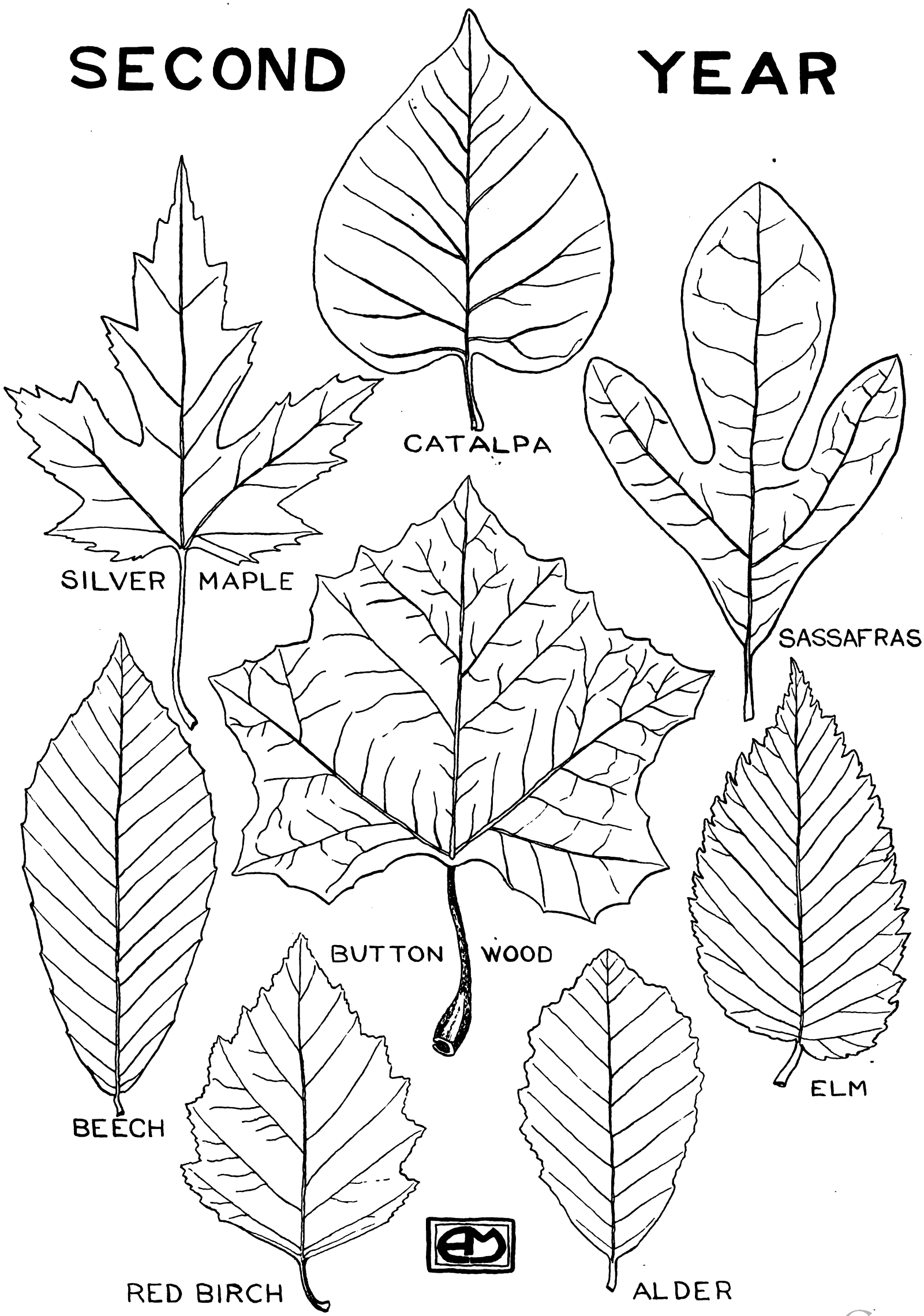
SECOND YEAR



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Beech. The leaves of the native American Beech are very distinctive in form and of a beautiful color and texture. They usually change to a yellowish hue as they fall in autumn, later turning to a very beautiful chocolate-brown. It is desirable that the green leaves should be studied early in September, and then the changes in coloring be noted as the weeks go by. The leaves are of a good size for mounting, and those which have fallen to the ground are readily pressed and are of such a texture that they do not break easily. The only other leaf that the children are likely to confuse with this is that of the Chestnut, so that it will be well not to attempt to teach both leaves at the same time. If it is possible to get the Beech nuts in their interesting husks, they should, of course, be shown in connection with the leaves. The Beech is a widely-distributed American tree and has often been planted in cities for shade and ornament.

Elm. The leaves of the Elm are probably available in almost any locality, and may serve admirably as one of the simplest leaves for study. Children readily learn to recognize it by sight, noticing the pointed tip, the saw-tooth-like or serrate margin and the unequal sides. They will see, also, the green color of the leaves upon the trees early in September and the yellow color of those that fall a little later. They can get a tactile impression of the rough surface of the leaves by handling them, and will readily learn to differentiate the Elm leaf from that of the Tulip tree and other kinds with smooth surfaces by means of the finger tips and with closed eyes. The Elm leaves, both when green and when yellow, are very easily pressed and may be mounted upon sheets of paper as readily as any of the pasting which the children do.

Red Birch. In many parts of Massachusetts the Red Birch is one of the most characteristic trees, especially along river banks. It

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may be known by the ragged, reddish bark which gives the trunks of even young trees a very characteristic appearance. The leaves are doubly serrate and generally have a more or less wedge-shaped base. As they fall in autumn they turn a deep brown color. In case the Red Birch is not available in a given locality, the Black Birch or the Yellow Birch may be substituted for it.

Alder. One or more kinds of Alders are found along the margins of nearly every stream or pond in Massachusetts. It is known to nearly everyone and the leaves form interesting objects for study. In addition to the leaves, one will find upon the shrubs in autumn the cone-like fruits which contain the seeds between the scales.

Common Locust. This tree is widely distributed in the State, and is easily recognized by its somewhat large and handsome pinnately-compound leaves, as well as by the characteristic spines and the pod-like fruits. Two or three leaves, carefully pressed and mounted by the teacher, will serve a useful purpose in giving distinct visual images to the pupils. The leaves are so likely to break apart when handled by the children that it may not be worth while to attempt to have them mount pressed specimens.

Butternut. A still larger form of pinnately-compound leaves, which it is desirable to teach in connection with that of the Locust, is found on the branches of the Butternut, a tree which also is widely distributed in the State. These leaves are too large for the pupils to mount, but two or three specimens upon sheets of cardboard will serve the purpose of instruction, and it will be a simple matter in most localities to have the children handle and smell the peculiar nuts of the trees.

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Key-fruits

of

Ash-leaved Maple

Ginkgo

Leaf

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THIRD YEAR

Chestnut. The type of leaf form represented by the Chestnut is one of great elegance and beauty. The burs and the nuts should be utilized in connection with the leaves for in-door study. After the leaves have fallen to the ground, for a short time they change to a beautiful brown color and are so firm in texture that they are easily handled without breaking.

Canoe Birch. The Canoe Birch or Paper White Birch is found in many parts of the State, and is so associated with many interesting passages in New England literature that it is a particularly attractive tree for study. The leaves are easily distinguished from those of the other Birches by their form and thickness, whiie the bark is notably characteristic.

Hawthorn or Thorn Apple. The interesting, doubly-serrate leaves of this tree are available almost everywhere and are sufficiently distinctive to be attractive to children. At least one twig with the curious thorns upon it should be used in connection with the lesson, as it will help greatly in fixing the name in mind, as well as in completing the mental image of the appearance of the tree.

Norway Maple. Where the Norway Maple is available, as it often is in eastern cities, it is a pity not to utilize the elegant and graceful

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key-fruits in the work of the children. These are flattened so that they are readily mounted, and they show better than any other Maple key the adaptation to dispersal by the wind, falling in a way which is sure to attract the interested attention of the pupils. By holding one of these keys high up and letting it fall, the whirling motion will be readily seen. As units of design the keys of this Maple are among the most beautiful objects in Nature. Where Norway Maples are growing along the streets, the sidewalk will often be covered with these fruits during the last half of October. In five minutes one could readily collect enough to last for years in the school work.

Cottonwood. In many parts of the State the Cottonwood has been planted as a shade tree, often in the guise of a horticultural variety, called the Carolina Poplar. The larger leaves have a characteristic outline which is readily distinguished; but the smaller ones, towards the tips of the branches, are sometimes not easily differentiated from the leaves of the Lombardy Poplar, which, however, is readily known by the characteristic vertical direction of the branches. In case the Cottonwood is not available, the Lombardy Poplar may very well be substituted.

Ash-leaved Maple. The Box Elder or Ash-leaved Maple, as it is variously known, has been commonly planted as a shade tree in the State. It is of interest on account of its characteristic compound leaves and its rather small key-fruits, which are commonly borne in great abundance. In case the Box Elder is not available and the Sycamore Maple is, the latter may very well be used; while if neither are present, the Linden or Basswood may be substituted to advantage.

Ash. The leaves of some one of the common species of Ash serve very well to fix in mind the type of the pinnately-compound

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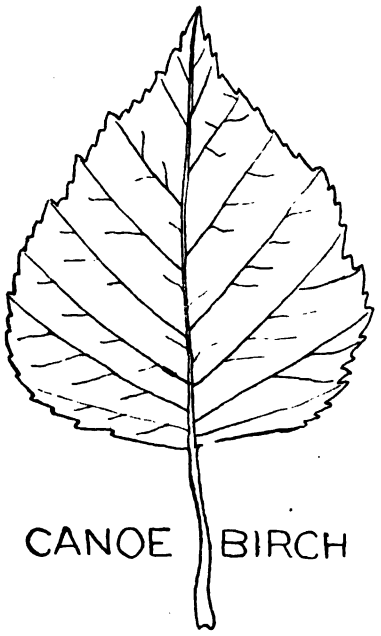
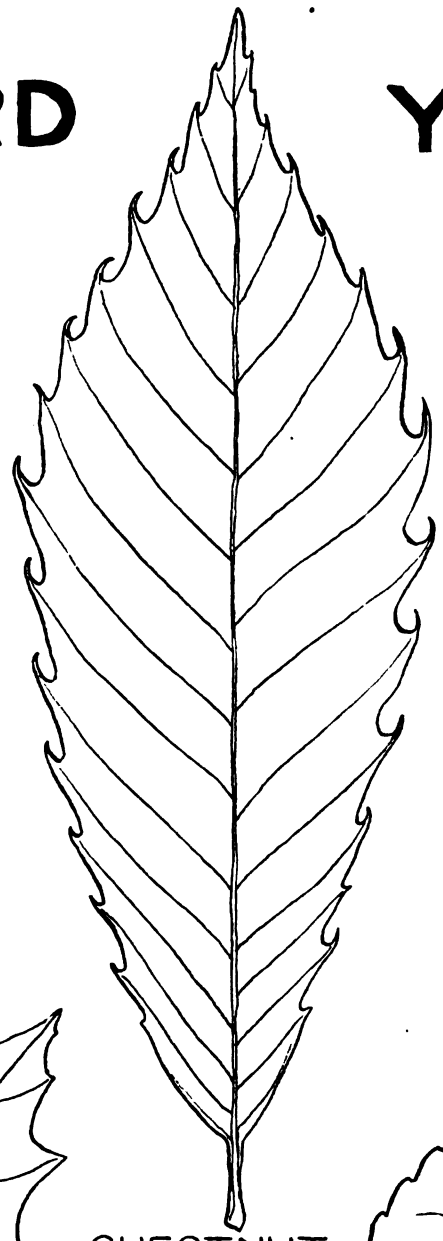
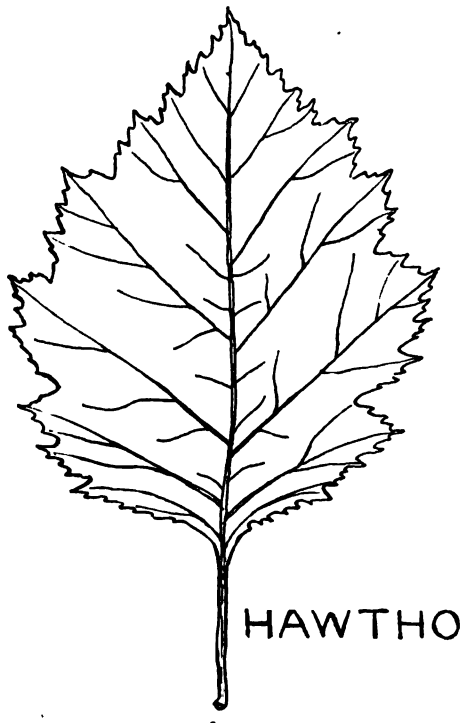
THIRD YEAR



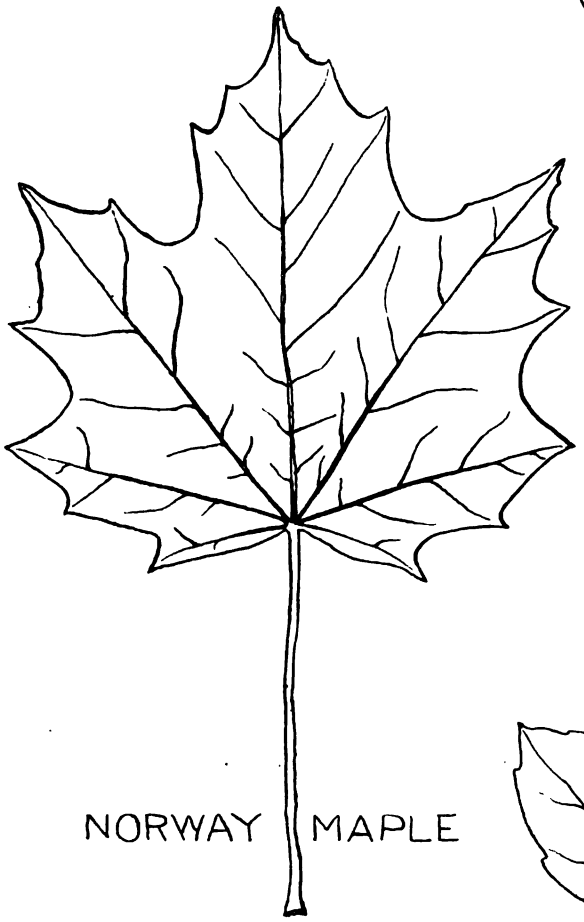
CANOE BIRCH



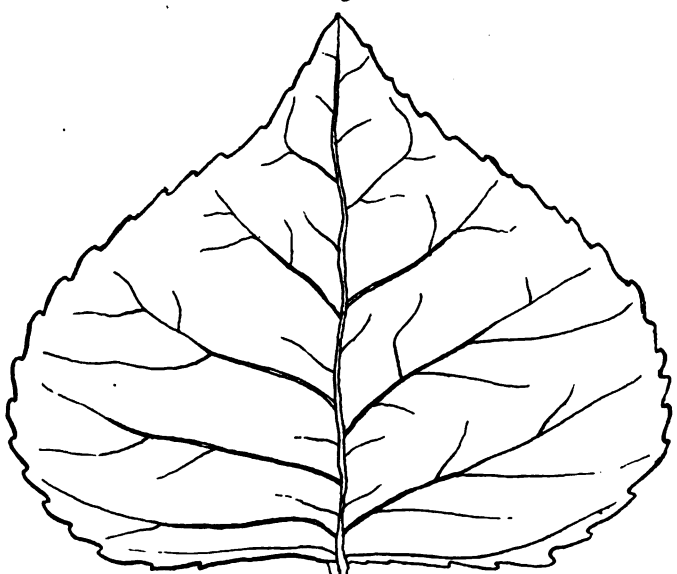
CHESTNUT

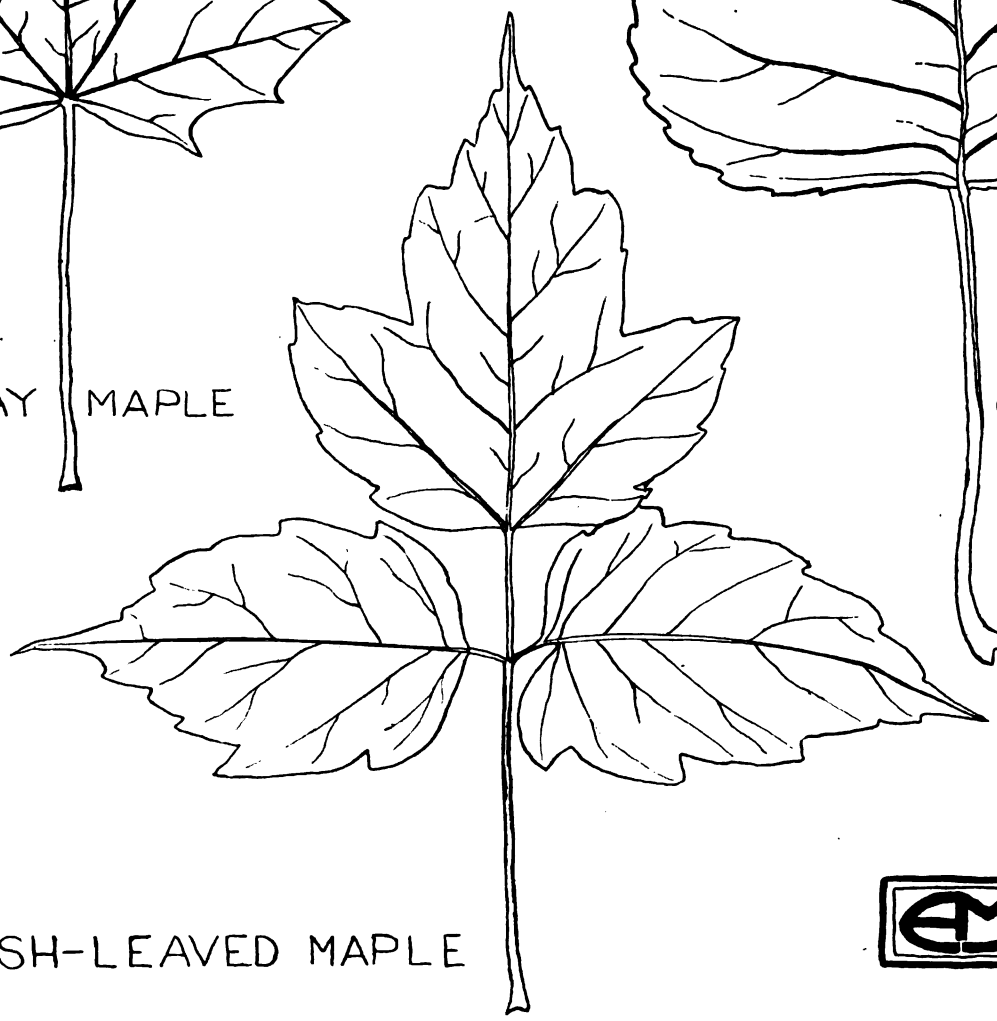


HAWTHORN

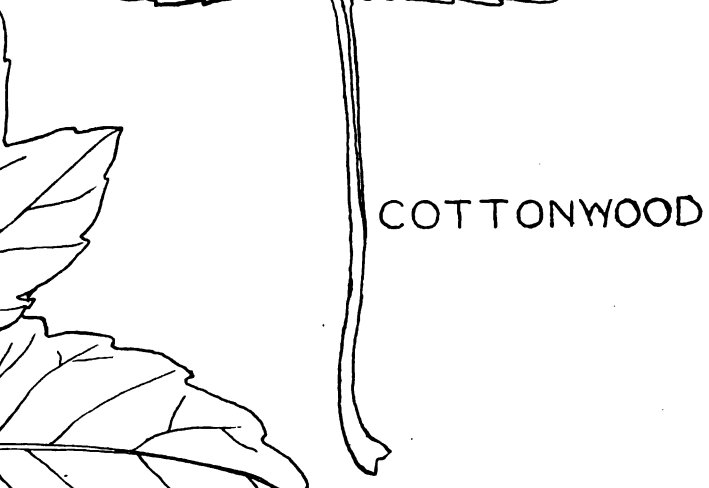


NORWAY MAPLE





ASH-LEAVED MAPLE



COTTONWOOD

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leaf, although, of course, this technical name need not be given to the child unless the teacher thinks it wise. The leaves of the three or four common species are so similar that it makes little difference which one is chosen, and it is probably not worth while to attempt to differentiate the precise species, but it is well worth while to give the child a definite mental image of this form of leaf structure. As in the case of the Horse Chestnut, two or three mounted by the teacher will answer this purpose without the necessity of having each child mount a leaf, — a process which would be likely to involve a considerable breaking off of leaflets. It does not seem to me desirable that the children should mount the individual leaflets in place of the whole leaf, as they are thus likely to substitute in their imagery the former for the latter. It is also well worth while to connect the curious and interesting key-fruits of the Ash tree with the leaves. Where an Ash tree is present these can be obtained in great abundance, and may well be given to the children in sufficient numbers to utilize in making temporary designs upon their desks. If a canoe paddle is available to show the children, the resemblance between the form of this and that of the ash keys may be pointed out.

The White Ash or American Ash is the most abundant species of the family and is the one most likely to be found. It may be known by its smooth, hairless leaf stems, each leaflet having a short stalk and being lighter green on the underside.

Sumach. The leaves of the Sumach form one of the most conspicuous features of our autumn landscapes. We have three common species which are easily differentiated. The Velvet or Staghorn Sumach is known by the velvety hairs upon the young bark. The Dwarf Sumach is known by the winged margins of the stems of the compound leaves. The Smooth Sumach is known by the smooth bark and the fact that the stems of the leaves are not winged. These

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three species have red berries, while the Poison Sumach, concerning which the children should be warned, has white berries. The common Poison Ivy is also a sumach, with white berries and characteristic leaves. Pupils should, of course, be warned against these two plants.

Hickory. The Hickory is very commonly called Walnut. There are many species, and it does not matter which one is used in connection with the third year. The Mockernut Hickory has fragrant buds and leaves, and is a good one to use on this account.

Honey Locust. The Honey Locust may always be known by its large thorns upon the bark, as well as by its large, doubly-compound leaves. These leaves are difficult to press and mount, and it will hardly be worth while to have the children attempt it in the case of the larger specimens. If there is a tree in the vicinity of the school, however, it will be no difficult matter to enable all the pupils to know it at sight.

Other Trees. It is hardly probable that many schools will find all the trees listed in these pages near their grounds. In case others not here listed are present, the latter may, of course, be substituted. The object is to give the pupils a real acquaintance with as many of the trees of their environment as possible, and to have definite lists, so that their knowledge will progress from grade to grade.

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THE STUDY OF TREES IN OUR PRIMARY SCHOOLS

AN EXPLANATORY NOTE

THESE pages are intended primarily to present suggestions for the autumn study of trees in the three lower grades of the primary schools. They are based upon the results of many years' experience, especially the last four years in the Training Schools connected with the Lowell Normal School. The limits of the article preclude a discussion of the methods used in the study of these trees in the same grades in winter and in spring, as well as of the study of the evergreens, which is taken up in winter. It is also impracticable to give here an outline of the tree study in the grades above the third, though in the fourth many of the trees are included in a study of methods of seed dispersal, and in the fifth and sixth the definite study of the commoner families of trees is taken up.

The greatest difficulty is that of getting the leaves of those trees which do not grow near the school. We are gradually overcoming this, however, by planting such species on or about the school grounds, so that all phases of the life of each may be studied near at hand. A few trees added each year would soon enable any school to have facilities for such tree studies, and it seems very desirable that the new trees planted should be of kinds which are useful in this way. In the case of the willows and poplars, it is only necessary to thrust a vigorous branch into ground that is fairly moist to get a new tree started, and, in the case of many others, young trees are readily transplanted from the woods or roadsides. Trees for such planting will also be furnished by the State Forester at cost of digging, packing and shipping, so far as they are available, from the State nursery.

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